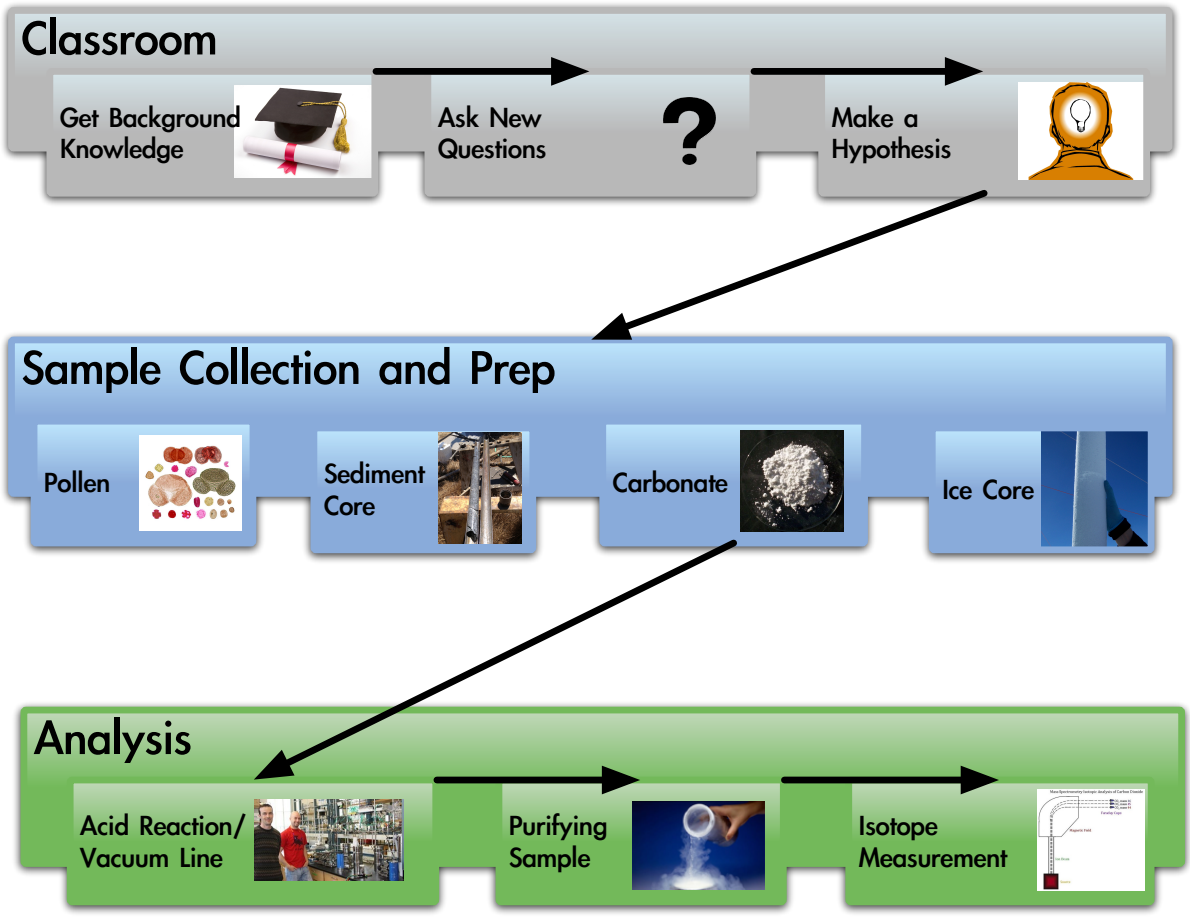
Paleoclimate Research

Field Trip to the Stable Isotopes Laboratory at University of Washington

Workbook • Hosted by Dr. Katharine Huntington • April 15, 2014

Student Name



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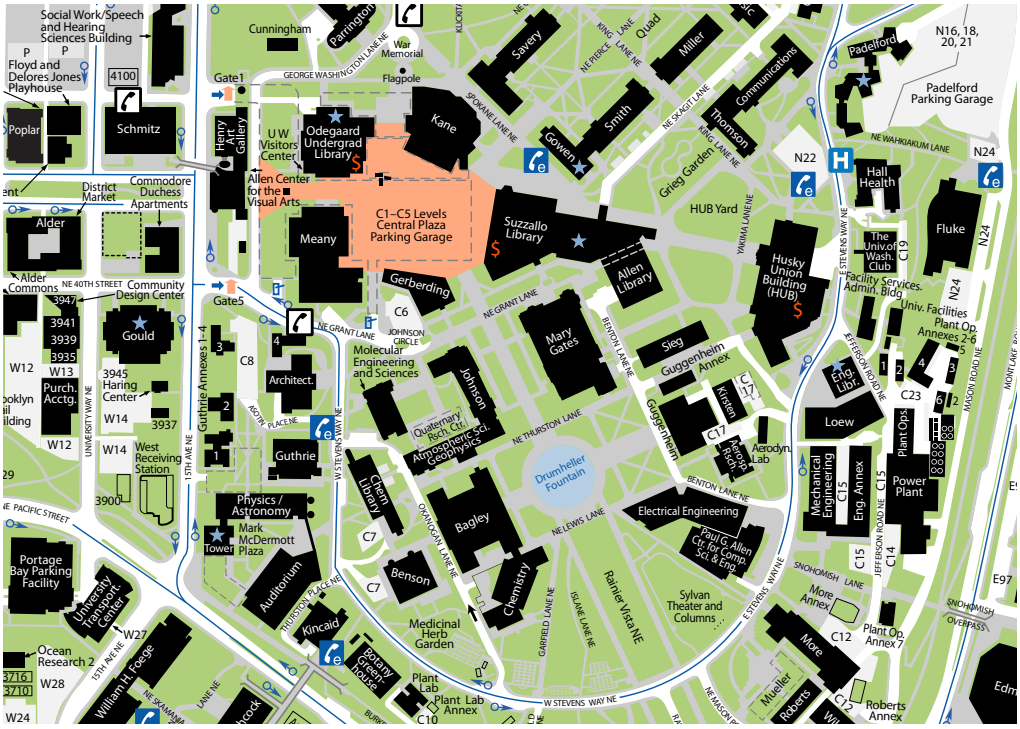
Planning

How will I know where to go?

MY ITINERARY

Time	9:00	9:20	9:40	10:00	10:20	10:40	11:00	11:20	11:40	12:00
Activity										lunch
Room										HUB

CAMPUS MAP



UW Campus

College Tour

What is it like to be a student here?

LAB DEMONSTRATION: VOLCANOES AND CLIMATE

1. What is one way volcanic eruptions influence climate?

2. What is one thing that determines how explosive a volcanic eruption will be?

QUESTION AND ANSWER WITH COLLEGE STUDENTS

1. Why did your guide choose to go to college?

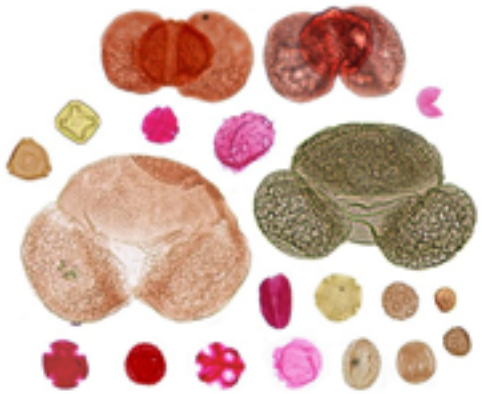
2. What was one struggle he or she faced so far with college?

Sample Collection and Prep

Where do the samples come from? What do they look like?

POLLEN ANALYSIS

221 Johnson Pollen Lab



Questions

1.How does pollen help scientists understand changes in climate?

2.What are some similarities and differences between our pollen lab in class and what you saw in the pollen lab here today?

ICE CORE

303C Johnson, hallway outside freezer

In places where it stays cold all year round and the snow never gets a chance to melt, large glaciers and ice sheets form over time. We know that the deeper down in the ice you go, the older the ice is, and we can analyze the gas trapped in the little air bubbles and the ice itself to get information about climate.

Questions

1.Where did this ice core come from?

2.What made that location a good one for studying?

3.How does ice help scientists understand changes in climate?

SEDIMENT CORE

318 Johnson Erosion Lab

Sediment Cores are collected from the bottoms of lakes or oceans to analyze the information stored in the sediment. We know that the further down we go the older the material is, so we can use that to make a timeline and form conclusions about the data we collect, be that pollen data, carbonate data, or something different we find in the sediment.

Questions

1.Where did the sediment core come from?

2.What made that location a good one for studying?

3.How does lake sediment help scientists understand changes in climate?

CARBONATE

318 Johnson Erosion Lab

Carbonate can be collected in many ways because it is found in many things in the environment. Carbonate is in shells, can form on the bottoms of rocks, and can be collected from soils. No matter the source, you still need to collect enough sample for the next step, which is the acid reaction.

Questions

1.How accurate was the scale?

2.What was the white powder you were collecting?

3.What was the name of the tool you used?

4.What is the next step for the powder?

5.Why did you have to have a specific mass of white powder?

Carbonate Analysis

How do we get data from dirt?

ACID REACTION AND CO_2 TRANSFER

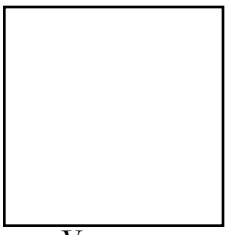
303 Johnson, Stable Isotopes - Sample Prep Lab

Carbonate minerals grow in the environment, and their isotopes record climate. Our instruments can't measure isotopes in solid carbonate, so we have to turn samples into CO2 gas to analyze. To do this, we react the carbonate with acid to release CO2 that we can analyze on a mass spectrometer.

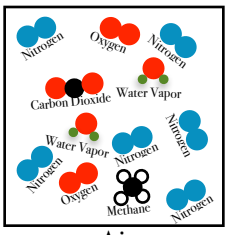
Vocabulary:

Vacuum- a space that is empty of matter

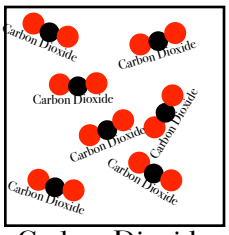
Air- A mixture of gas molecules



Vacuum



Air



Carbon Dioxide

Goal 1: React carbonate with acid to release the CO2 gas

Goal 2: Get the CO2 out of the reaction vessel without contaminating it with air.

Goal 3: Transfer the CO2 gas to a small tube that fits on the mass spectrometer to be measured.

Questions:

1. How do you turn your carbonate mineral sample into CO2 gas that you can measure?

2. How do you make sure your sample of gas doesn't get mixed with the atmosphere gas?

PURIFYING SAMPLE

317 Johnson

Moving around Carbon Dioxide gas without letting it escape or get contaminated with air is not easy. We use the different freezing points of the materials to move and purify our samples. This activity is designed to help you understand how we do that.

You will have 3 tubes. One is a tube of CO_2, one is water vapor, and the third is vacuumed empty. Use the information about freezing temperature below to deduce which tube contains which gas

1. Reference Data

Substance	Freezing Point
H	0°
CO	-78.5

2. Measuring Temperature

Liquid	Temperature	What would freeze at this temp?
ethanol/Dry Ice Slush (CO		
Liquid Nitrogen (N		

Tube	Did it freeze in:		What is the substance?
	Dry Ice	Liquid N	
A			
B			
C			

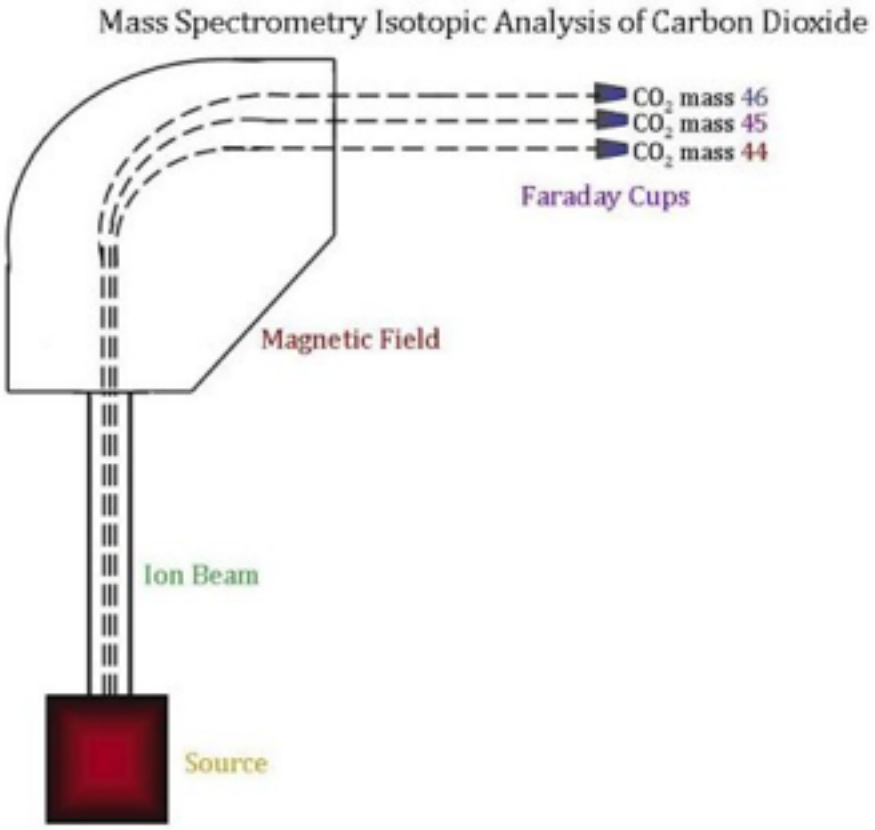
Questions

1.How did you know which tube was the CO_2?

ISOTOPE MEASUREMENT

302A Johnson, Stable Isotopes- Spectrometer Lab

This piece of equipment analyzes the gas we have collected to give us information about the isotopes. There is a direct relationship between isotopic levels and the temperature, so we can use the data from this machine to make conclusions about what the temperature was while each sample was forming. This combined with the knowledge of when the sample formed can allow us to build a picture of changes in climate over time.



Questions

1.What is an isotope?

2.What was the instrument you used to measure isotopes?

3.Where did you obtain carbon dioxide for this example?